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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/507,053	08/04/2005	Nobuo Ishii	157905-7001(P007)	8494

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EXAMINER	
DHINGRA, RAKESH KUMAR	
ART UNIT	PAPER NUMBER
1763	
MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/507,053	ISHII ET AL.	
	Examiner	Art Unit	
	Rakesh K. Dhingra	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 September 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 September 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *09/04, 04/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Drawings

Figure 8 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-4, 7-10, 13, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Otsubo et al (US patent No. 4,985,109) in view of Ishii et al (JP 2002-050615, which has an English equivalent, US PGPUB No. 2004/0045674).

Regarding Claims 1, 2, 13, 14: Otsubo et al teach a plasma apparatus/method (for example, Figures 1, 2, 8, 9) comprising a processing vessel 1 with a table 7 for placing an object 12 thereon, and a slot antenna 5 with plurality of slots 5a (located in a central portion and at an intermediate portion). Otsubo et al further teach that slot structure can also comprise triple structure that is, slots located at a central portion, a first intermediate portion and towards a peripheral portion, in a radial direction on the antenna surface. Otsubo et al further teach that microwave power radiated from the slots is dependent upon slots's radial location and to obtain uniform power output in double/triple structure of slots, parameters like slot position, length of slots, thickness of slot plate and width of slots etc are controlled (optimized) {as result effective variable}, and by relatively controlling the length of inner and outer slots uniformity of processing can be improved (for example, column 12, line 53 to column 13, line 23).

Otsubo et al do not explicitly teach radiation coefficient of slots increases from a central portion to a first intermediate portion on the antenna surface and then remains constant from the first intermediate portion towards the peripheral portion.

Ishii et al teach a plasma apparatus/method (for example Figure1, 2, 6-8) comprising a processing chamber 11 with a slot antenna 31 with plurality of slots 36. Ishii et al further teach that length L1 of slots 36 increases as the slots are located farther away from the central portion towards periphery in a radial direction on the center of antenna surface. Ishii et al further teach that as the microwave power is gradually radiated from the slots towards the periphery due to increase in slot length from the central portion towards an intermediate portion, the power of microwave in the waveguide decreases, that is, radiation coefficient (ratio of power radiated from the slot to the power in the waveguide) increases from the central portion towards the periphery as the slot length increases. Otsubo et al in view of Ishii et al

also teach that slot length is controlled (as a result effective variable) in accordance with radial distance from the center of antenna to obtain desired electric field distribution, that is, the radiation coefficient will also be controlled as per electric field distribution requirement (for example, paragraphs 0035 - 0049). It would be obvious to control the slot length and hence the radiation coefficient from the first intermediate portion towards the peripheral portion as per teachings of Otsubo et al in view of Ishii et al to obtain desired electric field distribution.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the length of slots and the radiation coefficient as per location of slots on the antenna surface to obtain desired radiation coefficient, as taught by Ishii et al in the apparatus of Otsubo et al to obtain desired electric field distribution in the processing chamber for improved uniformity of plasma processing.

In this connection courts have ruled:

It is well settled that determination of optimum values of cause effective variables such as these process parameters is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980).

Regarding Claim 3: Ishii et al teach that length L1 of slots 36 increases monotonously from the central portion till a first intermediate portion and is generally a maximum of lambda.g/2 (for example, Figure 2A and paragraph 0035).

Regarding Claim 4: Ishii et al teach that length of slots is larger than that of slot inside each slot from an inner most slot till an arbitrary slot on the antenna surface in a radial direction and is generally lambda.g/2 (maximum) {for example, Figure 2A}. Further, Ishii et al also teach that in region A2 (that is from an arbitrary portion towards an outer most slot), due to increased power density, the slot length can be reduced. Though Ishii et al do not explicitly teach that slot length from the arbitrary portion till the outer-most slot is same, it would be obvious to optimize the slot length from an arbitrary slot towards an outermost slot of the antenna surface as per teachings of Otsubo et al in view of Ishii et al to obtain

desired electric field distribution, as per process limitations (for example, Ishii et al – paragraphs 0042-0044).

Regarding Claims 7, 8: Otsubo et al in view of Ishii et al teach all limitations of the claim (as already explained under claims 1, 2 above) including that radiation coefficient vary depending upon slot length in a radial direction on the antenna surface, and the slot length is optimized (as a result effective variable) from a central portion to a first intermediate portion and towards peripheral portion, to obtain desired electric field distribution (Otsubo et al - for example, column 12, line 53 to column 13, line 23 and Ishii et al - for example, paragraphs 0035, -0049). It would be obvious to optimize the slot lengths over the antenna surface including from a first intermediate portion to a second intermediate portion and from the second intermediate portion until the peripheral portion, as per teachings of Otsubo et al in view of Ishii et al to obtain desired electric field distribution, as per process limitations.

Regarding Claims 9, 10: Otsubo et al in view of Ishii et al teach (as already explained above under claims 1, 2) that length of slots is optimized depending upon electric field distribution and is generally at a maximum lambda.g/2. It would be obvious to optimize the lengths of slots over the antenna surface between the inner most slot to a slot at a first intermediate portion, from a slot at a first intermediate portion till a slot at the second intermediate portion and from a slot at the second intermediate portion until the peripheral portion, to obtain desired desired electrical field distribution as per process limitations.

Claims 5, 6, 11, 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Otsubo et al (US patent No. 4,985,109) in view of Ishii et al (JP 2002-050615, which has an English equivalent, US PGPUB No. 2004/0045674) as applied to claims 1-4, 7-10, 13, 14 and further in view of Watanabe et al (US Patent No. 6,158,383).

Regarding Claims 5, 6: Otsubo et al in view of Ishii et al teach all limitations of the claim including that lengths of slots is generally lambda.g/2 (maximum) {that is, L >/= N *lambda.g/2, for N = 1} and the same is optimized in a radial direction on the antenna surface, as per desired electric field distribution.

Otsubo et al in view of Ishii et al do not teach that length of slot L satisfies the relation,

L < / = (N/2 + ¼) * lambda.g (that is, N < / = 0.75 * lmbda.g for N = 1).

Watanabe et al teach a plasma apparatus (for example, Figure 7) comprising a processing chamber 1 with slot antenna 7 having slots 8, and where slot length is kept larger than lambda.g/2, (which meets the claim limitation) depending upon thickness of conductor plate used for slot antenna, to enable propagation of electric field in the axial direction (for example, column 6, lines 25-50). It would be obvious to optimize the length of slot as per thickness of slot antenna plate in view of teachings of Watanabe et al and Otsubo et al in view of Ishii et al to obtain required electric field distribution as per process limitations (Otsubo et al – Column 13, lines 1-22).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize slot length relative to thickness of the slot antenna as taught by Watanabe et al in the apparatus of Otsubo et al in view of Ishii et al to enable propagation of electric field in the axial direction, as per process limitation.

Regarding Claims 11, 12: Otsubo et al in view of Ishii et al and Watanabe et al teach (as already explained above under claims 5, 6) that length of slots can be higher than lambda.g/2 and the length is optimized depending upon thickness of slot antenna plate. Further, as per teachings of Otsubo et al in view of Ishii et al (as explained above under claim 1) it would be obvious to optimize the lengths of slots over the antenna surface between the inner most slot to a slot at a first intermediate portion, from a slot at a first intermediate portion till a slot at the second intermediate portion and from a slot at the second

intermediate portion until the peripheral portion, to obtain desired electrical field distribution as per as per process limitations.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rakesh K. Dhingra whose telephone number is (571)-272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Rakesh K. Dhingra

Karla Moore
Primary Examiner
Art Unit 1763